

# GRAPHICS

ENGINEERING GRAPHICS 32A

DRAFTING 12, 12A

TOPOGRAPHY 22A

MACHINE DRAWING 22C, 32C

ARCHITECTURAL DRAWING 22B, 32B

# INDUSTRIAL EDUCATION 71

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CURRICULUM GUIDE

for

DRAFTING

Province of Alberta  
Department of Education

1971



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## A C K N O W L E D G E M E N T

The Department of Education acknowledges with appreciation the contribution of the following Drafting Ad Hoc Committee members to the preparation of this Guide.

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NOTE: This Curriculum Guide is a service publication only. The Senior High School Program of Studies contains the official statement concerning Senior High School Drafting. The information contained in the Guide is prescriptive insofar as it duplicates that contained in the Program of Studies. There are in the Guide, however, as well as content, methods of developing the concepts, suggestions for the use of teaching aids and lists of additional reference books.



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## I. INDUSTRIAL EDUCATION

Industrial Education is defined by the Alberta Department of Education as a continuum of experiences starting with industrial arts in the junior high school and expanding to the development of skills related to career fields. This development of the student's skills is planned for through courses in industrial arts and vocational education culminating in on-the-job work experience, or entry into a job or post-high school institution for further education.

The program consists of courses ranging from those designed for an exploration of the technologies and trade areas to units of practical preparation for a specific job. In between are courses which develop the student's knowledge of himself, his talents and his skills. While some course content requires much activity of a manipulative nature, other courses are more theory-oriented.

The Industrial Education course "guides" provide the teacher with an outline of the topics and concepts selected as most relevant for the physical and mental development of the students, the logical development of the subject area and the resources of the school in both teaching personnel and facilities.

The guide leaves much scope for the teacher to develop content related to the topics especially in writing behavioral objectives describing specific changes in student behavior expected from the learning tasks.

It is expected that each school district will develop a program of Industrial Education appropriate to the fulfilment of the needs of its student clientele.

## II. OBJECTIVES

The general objectives of Industrial Education complement the aims and objectives of the secondary school. The objectives of Industrial Education are to:

1. Develop basic competencies both academically and in work-skills to enter either a job or a post-high school institution for further education.
2. Provide courses that serve as a vehicle in helping students relate their academic knowledge to vocational competencies.
3. Provide the curriculum content in aiding students to develop fundamental tool and procedural skills which prepare them to enter a family of occupations.
4. Provide the environment whereby students may develop sound attitudes and habits of work.

Course objectives follow from these purposes.

The drafting courses should give the students an opportunity to:

1. gain proficiency and accuracy in both drafting and related theory
2. practice habits of neatness, cleanliness and orderliness in work situations
3. learn about positions and employment opportunities in the drafting industry.

### III. ORGANIZATION

#### A. GENERAL ORGANIZATION

The Industrial Education program is organized as a series of courses beginning with the industrial arts general courses and then expanding into seven career fields.

Entry to a career field is obtained by registering in one of the following courses:

1. an Industrial Arts cluster course (10)
2. a General Technology course (12 A)
3. an introductory course with the same title as the major (5 credits) (12)

Students accumulating 10 credits in a course sequence are defined as having a major and may take minors to broaden their understanding of their chosen career field. Chart 1 outlines the career fields. This is followed by Chart 2 which depicts the majors and minors for the career field outlined in this guide.

#### B. GUIDE ORGANIZATION

The course guides are developed on the following pattern:

1. Topic: Each course is subdivided into a number of topics.
2. Concept: The main generalization or "big" idea that students should learn follows each topic.
3. Sub-concepts: The sub-concepts divide the topic into the teaching components. They give more direction on specific areas that should be studied. Those marked with an asterisk (\*) should not be taught in the 12 A course.
4. Behavioral Objectives: These describe specific changes in student behavior which result from the learning tasks he performs.

The guide gives only a few sample objectives. It is the responsibility of the teacher to develop as many behavioral objectives as he can teach in the time available.

5. Suggested Activities: A few suggestions are made as to the types of activities that could be used to achieve the behavioral objectives.

6. Resource Materials: This column suggests where materials may be obtained.

### C. COURSE ORGANIZATION

Graphics consists of the major areas of Drafting, Graphic Arts and Commercial Art. A student may select a major by taking 10 credits in one of these followed by courses selected from the other two areas within the field or he may broaden his scope by selecting a minor from a different field.

Drafting, one of the major areas, consists of seven, five-credit modules. The introductory module may be taught for 2 1/2 credits as part of the General Technology course.

The modules need not be taught in any prescribed sequence other than that Architectural Drawing I is pre-requisite to Architectural Drawing II. The same applies to Machine Drawing I and II.

A student wishing to meet the requirements for recognition by the Apprenticeship Branch must complete one of Graphic Communications 10, Drafting 12 or 12 A and Drafting 22 B and C, 32 A and B, Building Construction 12 and Machine Shop 12.

Students planning to attend an Institute of Technology should develop a dossier of work completed in high school for evaluation and appropriate placement in the Institute program.

Many students, however, will take only one-to-three courses in drafting as part of their academic program, or to supplement other shop courses. The scope of the course selection allows the flexibility necessary for the program to be tailored to the needs of the individual class or student.

# I N D U S T R I A L E D U C A T I O N M A T R I X

CHART I

EXPLORATORY COURSES				
INDUSTRIAL ARTS AND HOME ECONOMICS COURSES AT THE JUNIOR HIGH SCHOOL LEVEL AND INDUSTRIAL ARTS GENERAL AT THE HIGH SCHOOL LEVEL (5-15) CREDITS				
CAREER FIELD	IND. EDUCATION GENERAL	IND. EDUCATION MINOR	INDUSTRIAL EDUCATION MAJOR	RELATED
GRAPHICS	GRAPHIC COMMUNICATION GENERAL TECHNOLOGY INTRODUCTION TO MAJOR	ANY COURSE FROM MAJOR COLUMN	DRAFTING GRAPHIC ARTS COMMERCIAL ART	WORK EXPERIENCE INDUSTRIAL ARTS BUSINESS EDUCATION
MECHANICS	POWER GENERAL TECHNOLOGY INTRODUCTION TO MAJOR	DRAFTING WELDING MACHINE SHOP ELECTRICITY BLDG. CONSTRUCTION	AUTOMOTIVES AUTO BODY AIRCRAFT MAINTENANCE AG. MECHANICS	AS ABOVE
CONSTRUCTION & FABRICATION	MATERIALS GENERAL TECHNOLOGY INTRODUCTION TO MAJOR	DRAFTING AUTO AUTO BODY ELECTRICITY	BLDG. CONSTRUCTION PIPING MACHINE SHOP WELDING SHEET METAL	AS ABOVE
ELECTRICITY ELECTRONICS	ELECTRONICS GENERAL TECHNOLOGY INTRODUCTION TO MAJOR	DRAFTING AUTO BLDG. CONSTRUCTION	ELECTRICITY ELECTRONICS	AS ABOVE
PERSONAL SERVICES	HOME ECONOMICS -FOOD SCIENCE -CLOTHING & TEXTILES INTRODUCTION TO MAJOR	DRAFTING COMMERCIAL ART	FOOD PREP. COMMERCIAL SEWING BEAUTY CULTURE HEALTH SERVICES	AS ABOVE HOME ECONOMICS
PERFORMING ARTS	GENERAL TECHNOLOGY INTRODUCTION TO MAJOR	DRAFTING ELECTRICITY BLDG. CONSTRUCTION	PERFORMING ARTS T.V. CRAFTS	AS ABOVE
HORTICULTURE	GENERAL TECHNOLOGY INTRODUCTION TO MAJOR	DRAFTING AUTO	HORTICULTURE FORESTRY	AS ABOVE



# INDUSTRIAL EDUCATION

## CAREER FIELD - GRAPHICS

CHART 2

### MAJORS

DRAFTING	GRAPHIC ARTS	COMMERCIAL ART
GRAPHIC COMMUNICATIONS 10 DRAFTING 12 DRAFTING 12A GEN. TECH.	GRAPHIC COMMUNICATIONS 10 GRAPHICS 12 12A GEN. TECH.	COMMERCIAL ART 12 12A GEN. TECH.
DRAFTING 22A TOPOGRAPHICAL 22B ARCHITECTURAL I 22C MACHINE DRAWING I	GRAPHICS 22A 22B 22C	COMMERCIAL ART 22A 22B 22C
DRAFTING 32A ENGINEERING GRAPHICS 32B ARCHITECTURAL II 32C MACHINE DRAWING II	GRAPHICS 32A 32B 32C	COMMERCIAL ART 32A 32B 32C

### MINORS

ANY "12" COURSES LISTED BELOW: BUILDING CONSTRUCTION MACHINE SHOP ELECTRICITY-ELECTRONICS WELDING SHEET METAL PIPING AUTO BODY AIRCRAFT MAINTENANCE GRAPHIC ARTS COMMERCIAL ART FORESTRY	ANY "12" COURSES LISTED BELOW: DRAFTING COMMERCIAL ART	ANY "12" COURSES LISTED BELOW: DRAFTING GRAPHICS
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RELATED: INDUSTRIAL ARTS, BUSINESS EDUCATION, WORK EXPERIENCE/STUDY

A. INTRODUCTORY DRAFTING 12 and 12 A





#### IV. COURSES

##### A. INTRODUCTORY DRAFTING 12 and 12 A

###### 1. Introduction

The general objective of this course in exploratory drafting is to provide the student with experiences that allow him to sample the various kinds of drawings used within the field generally. These activities should enable him to make an informed decision about further studies in the drafting field.

The Drafting 12 course is a five-credit course. The Drafting 12 A course consists of content selected from the 12 course which is equivalent to 2 1/2 credits or 65 hours in time. The 12 A is one component of the General Technology course and must be paired with a 12 A course from some other course area.

###### 2. Textual Materials

No single text is prescribed.

References (Those marked with an \* are considered the most useful.)

\*Canadian Standards Association, *Mechanical Drawing Standards*, B 78-1

\*Davis, E. J., and H. F. Skinner, *New Basic Drafting*, General Publishing Co. Ltd.

Jensen, C. H., and F. H. Mason, *Drafting Fundamentals*, McGraw-Hill

###### 3. Course Content

###### Topic 1. Drafting Equipment

Concept. A knowledge of the use and handling of drafting equipment is basic to the writing of the drafting language.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Care of instruments is necessary for good work	Given a basic set of drawing equipment the student will take care of and be able to adjust equipment in the manner prescribed by acknowledged practice.	Identify and learn to clean and/or adjust drafting equipment.	

Topic 1. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
2) Drawing instruments are used in the production of drawings.	Given a basic set of drawing instruments the student will be able to use the equipment in a manner prescribed by the teacher to draw simple geometric shapes.	Draw simple geometric shapes, eg. garden gates, graphs, charts, survey plots, symbols from various fields, simple objects, etc.	
*3) "Specialized" equipment is used in the various fields of drafting.	Given "specialized" equipment (lettering devices, templates, scales, drop spring bows, contour pens, proportional dividers and others) the student will learn to use the equipment on practice exercises.	Practice exercises may include the production of signs, charts, etc. that require the use of specialized equipment.	
*4) Various kinds of paper are used in making drawings	Given samples of various tracing papers, films, and cloths, the student will correctly identify each type and list the advantages of each.	Discussion Experiment by drawing on various papers.	

\* - Not to be taught in the 12 A Course.

Topic 2. Shape Description

Concept. A knowledge of shape description is basic to reading and writing the language of drafting.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Line language is basic to describing shape	The student will be able to describe object lines, hidden lines and centre lines as given in the CSA Mechanical Engineering Drawing Standards and to tell the purpose of each.	Draw lines noting correct sizes for spaces, dashes, thickness, etc.	

## Topic 2. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
2) Different basic methods are used to represent objects on paper.	<p>Given multiview, axonometric, oblique and perspective drawings of an object, the student will be able to identify each type by name.</p> <p>Given partially completed multiview drawings, the student will be able to complete the drawings.</p> <p>Given pictorial drawings, the student will be able to produce multiview drawings.</p>	<p>Orally discuss methods. Answer test questions.</p> <p>Add missing lines. Add missing views.</p> <p>Sketch and draw multiview drawings.</p>	

## Topic 3. Lettering

Concept. Lettering is a skill basic to the writing of the drafting language.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Gothic vertical upper case is basic to other styles of lettering and is most used in industry.	The student will be able to produce uniform, legible, dense, sharp, vertical upper case letters that are correctly proportioned and are correctly spaced in words and sentences.	Practice lettering regularly on drawings and on separate lettering sheets.	

Topic 3. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
*2) Various styles are used in special areas of drafting.	The student will be able to produce letters which are extended, condensed, inclined, upper and lower case and are dense, uniform, correctly proportioned and correctly spaced.	Practice sheets. Use various styles in note-taking and on drawings.	

Topic 4. Geometry

Concept. Drafting geometry is basic to the writing of the language of drafting.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
1) Geometrical constructions are applied in the drawing of all objects.	<p>Given drawing instruments, the student will be able to draw objects which incorporate the following geometrical constructions:</p> <ul style="list-style-type: none"> <li>a. draw lines parallel to given lines</li> <li>b. draw lines perpendicular to given lines</li> <li>c. bisect straight and curved lines</li> <li>d. divide a line into equal parts</li> <li>e. bisect an angle</li> <li>f. draw a hexagon, an octagon and a pentagon</li> <li>g. draw tangent arcs given various conditions</li> </ul>	Draw objects which include the required constructions.	

Topic 4. Continued

Sub-Concepts	Behavioral Objectives	Suggested Materials	Resource Materials
	*h. draw an ellipse *i. draw other constructions deemed to be necessary to the production of drawings.		

Topic 5. Reproduction of drawings

Concept. Multiple copies of drawings are required by industry.

Sub-Concepts	Behavioral Objectives	Suggested Materials	Resource Materials
1) The white print machine is the most versatile and most commonly used machine.	Given a drawing, the student will be able to run prints of it and will be able to describe and identify various kinds of prints available from the diazo process.	Make white prints of their drawings. View samples of prints.	
*2) Micro filming, multilith, photography, xerox and other techniques are used to reproduce drawings made in industry.	Given samples of various kinds of prints the student will be able to identify each and to determine the relative expense of each.	View samples.	
*	Given a method of reproduction, the student will be able to describe orally to the class (or written on a test) the process	Tour a reproduction company. Answer test questions. View samples of kinds of prints.	



Topic 5. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
	used in this method. eg. micro film multilith xerox photostat Diazo		

Topic 6. Pictorial drawings

Concept. Pictorial drawing is basic to drafting.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Pictorial drawings are used to check a design and to formulate ideas in solving drafting problems.	Given a multiview drawing of an object the student will be able to sketch and draw the object using axonometric or oblique projection.	Make freehand and instrument drawings in axonometric and oblique. Check solutions to multiview problems by making a pictorial sketch.	
*	Given an object, the student will be able to make a perspective, freehand sketch of the object.	Make freehand perspective sketches.	

## Topic 7. Sectional views

Concept. Interiors of objects, often too complicated to show by the use of hidden lines, are depicted by means of sectional views.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
1) The cutting plane is a concept basic to sectional views.	Given two or more views of an object, one in section, the student will be able to locate correctly the cutting plane line and add arrows to show direction of lines of sight and add identifying letters.	Indicate which view the cutting plane line should be in. Add arrows to sectional drawings which show where cutting plane is to be placed. Describe the use of the cutting plane line and the purpose of the symbols connected with it.	
2) Section lines are basic to showing interiors of objects.	The student will describe the purposes of section lines and identify the symbols for materials specified by the teacher.	Oral identification. Written tests.	
3) Different types of sections are used to describe the interiors of objects.	The student will draw full and half sections given two or more views of the object.	Instrument drawings. Freehand sketches.	
	* The student will draw removed, revolved and broken out sections as specified by the teacher.		

## Topic 8. Auxiliary views

Concept. Views other than the six basic views of multiview projection are often required to describe shape completely.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
*1) Inclined surfaces require the use of a primary auxiliary view to describe its true size and shape.	Given two views of an object with an inclined surface, the student will be able to add the auxiliary view.	Instrument drawing. Solve given problems.	

## Topic 9. Dimensioning

Concept. Size description is basic to the language of drafting.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Dimensioning requires the use of special symbols and rules as set down by the CSA.	Given a dimensional drawing, the student will be able to identify the elements as specified by CSA Mechanical Engineering Drawing Standards clauses 5.4.2 to 5.4.12.	Label the elements of a dimensional drawing. Demonstrate to the rest of the class.	
*2) Dimensions must be carefully selected when sizing an object.	Given an object the student will be able to select the dimensions required to describe completely the size of the object.	Sketch dimensions onto a given drawing. Using instruments draw in the proper dimensions.	



Topic 9. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
*3) Shop directions are required when giving size description.	<p>Given a specific shop process, the student will be able to give the proper shop directions and notes.</p> <p>Given an object the student will be able to draw the object giving complete size and shape description.</p>	Draw objects that require size and location of drilled holes, countersinks, counterbores, spot faces, etc.	

Topic 10. Detail drawings

Concept. Detail drawings and conventions (the production of a complete set of instructions) are required for the production of objects.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
*1) Detail drawings are complete drawings of a given part.	Given an object, the student will be able to determine the views required to describe completely the object and to produce a drawing that is complete, accurate, and dimensioned, correctly showing sectional views, auxiliary views and shop directions where required.	Produce detail drawings of simple objects.	

Topic 11. Occupational Information

Concent. A knowledge of occupational areas will help students plan course work to achieve their vocational goal.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Students must receive information on future courses.	Given a program of studies, the student will plan his high school program.	Study course descriptions. Visit other classrooms and shop areas.	
2) Students should learn about the vocations in their communities.	Given a realistic appraisal of his characteristics, the student will outline the vocations he would like to prepare for.	Visit convenient work stations.	

B. TOPOGRAPHICAL DRAWING 22 A



B. TOPOGRAPHICAL DRAWING 22A

1. Introduction

The objectives of this course are to:

- (1) familiarize students with various charts and maps
- (2) permit students to become reasonably competent with ink equipment as most map work is done in ink
- (3) make students aware of the many other uses of plans and maps.

Activities students will participate in and materials they will learn about include:

- use of instruments in topographical drawing
- compass reading, magnetic declination
- surveying
- draw latitude-longitude grid
- learn about township and range grids
- methods of drawing land forms
- uses of air photos
- using a stereoscope

2. Textual Materials

- \* Sloane and Montz. *Elements of Topographical Drawing*, McGraw-Hill, \$8.35
- Chevrier. *Topographic Map and Air Photo Interpretation*, Macmillan, \$5.20
- Greenhood, David. *Mapping*, University of Toronto Press, \$2.95
- Raisz, E. *Principles of Cartography*, McGraw-Hill, \$9.28
- \* Department of Mines and Resources, Ottawa. *Every Square Inch*, \$12.5
- Gopsil, G. *Practical Geography*, Macmillan, \$5.00
- Marsh. *All About Maps and Map Making*, Random House, \$3.00
- Atlas of Alberta*, University of Alberta Press, \$20.00
- Supplement to the Manual of Instruction for Survey of Canada Lands*.  
Queen's Printer, Ottawa, \$3.00
- Bygott, John. *Introduction to Mapwork and Practical Geography*, University Tutorial Press, \$8.00
- Edward, Bennison. *Introduction to Geological Structures and Maps*, (2nd ed.), Arnold Publish - London, Macmillan, Toronto, \$1.90
- Maps and Diagrams*. University Paperbacks. Monkhouse and Wilkinson, London, \$1.75
- Boggs. *Maps - How to Read and Interpret Them*. \$2.00.
- Roblin, H. S. *Map Projections*. Macmillan, Toronto, \$1.85

Minshull, Roger. *Landforms from the Air*. Macmillan, \$1.65

Dickinson, G. *Maps and Air Photographs*. Macmillan, \$7.95

Baldock, E. D. *Map Production*. Information Canada.

Bartholomew, John. *Time's Atlas of the World*. The Times, \$45.00

### Basic Student Reference Non-Print Materials

Source "The Experience Group"  
4041 West 36th Avenue  
Vancouver 13, British Columbia

EG Representative Topographic Maps of Canada  
Book of 10 Pkgs., \$8.50

EG302 Structured Pictures of North America, \$11.50

Alberta Township Plans, @\$0.50

Alberta Government Map 1" = 16 miles

Topographical Maps (Federal), Scale 1: 50,000 @ \$1.00, Queen's Printer

Topographical Maps Scale 1:25,00 @ \$1.00, Queen's Printer

Air Photographs @ \$0.50, Ottawa.

### 3. Course Content

Topic 1. Introduction to Maps

Concept. Topographic maps are two-dimensional plans of the earth's surface

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Various maps have special purposes, therefore we must be able to read or understand plans.	Given a set of published maps, a student will suggest uses such as: tourist road map, maps showing land forms; geographical uses; land uses such as forestry, agriculture or population.	Examine maps from "Every Square Inch" and give uses for each.	

Topic 1. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
2) Understanding what a map or plan is used for determines what will be shown on that plan.	<p>On a Lot Plan, students will identify features that are necessary to locate a house on that plan, considering: slope of land, view, shape of the lot, access and utility locations.</p>	<p>On a given city or town lot plan, students will sketch in a single family dwelling with a garage considering view, slope of the land, existing foliage. Use of a government or local maps would help determine the above.</p> <p>Using a road map, aided by topographic maps, plan a road trip or hike that would avoid steep grades, yet go through picturesque land. Consider forestation, density, lakes, muskeg, etc.</p>	
	<p>Given, ruling pens, guage pens, compass, reservoir pens and contour pens, students will do line work with the aid of irregular curves and straight edges.</p>	<p>Using (a) speedball nibs, (b) straight pens, (c) technical reservoir pens, letter both vertical and slant in upper and lower case with smooth, parallel strokes of even height. Practice pages of various heights should be given for each instrument.</p>	
	<p>Given shot weights, straight edges, and a mechanical lettering set students will be able to letter both slant and vertical.</p>	<p>Using all pens for line work, students do geometrical designs.</p>	







Topic 1. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
	<p>Using colored crayon and solvent, paints, dyes or air brush, students will color code any of the above symbols.</p> <p>Using a transparent or semi-transparent base map and Diazo printer, students will reproduce a copy of a map.</p>	<p>On the above map, prepare a legend with ink.</p> <p>Using a diazo of the above map color in the map and legend.</p>	

Topic 2. Map Guides

Concept. All maps must have some method of orientation or location.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) An appropriate scale must be selected to suit the map area, page size either as a ratio or as an equivalent.	<p>Using the National Topographical scale ratios, students will be able to select the proper measuring stick to calculate distances in any unit of feet, yards, or miles from:</p> <p>1:25,000 1:50,000 1:63,360</p> <p>Given a published map, <u>1</u> 50,000, students will record distances between points and give the actual distances.</p>	<p>Record distances between given points and give the actual distances</p> <p>Draw a lot plan.</p>	

Topic 2. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
2) Direction is a theoretical line relative to a given starting point and is measured as North-South-East-West or in degree	Using a Civil Engineer's Inch-Decimal scale, students will be able to use 1/10, 1/20---1/16 scale ratio for any measurement and draw a city or town lot plan 60' x 100' on a 8 1/2" x 11" linear sheet to scale	Students could then make a cardboard papier mache and cloth model of their design work as an extra project	
	Using multiple dividers and ink equipment, students will draw any graphic scale as open divided	Design a graphic scale for the above lot plan using yards and feet	
	Given a drafting machine the student will learn how to use a vernier scale	With a drafting machine or surveyor's transit, turn a given angle	
	With the aid of published maps, atlas and magnetic compass students will know: 1) Azimuth 2) Magnetic north (bearing) 3) True north (true bearing) 4) Grid north	On a map of the school locale, and using a drafting machine (or protractor) give angular readings from a given line to other points  Give a bearing reading on a published map to other points on the map  Students could take a short field trip with map and compass to compare a map grid north or true north with a magnetic north	

Topic 2. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
3) Magnetic Declination corrects a magnetic bearing to true north depending on the location east or west of the Aganic line	Given a magnetic compass (or transit), a student will plot a true north line on a map	Convert a magnetic reading from a true north reading given any declination east or west	
4) A north symbol is placed on all maps or survey plats	Students will draw maps or plans with north at the top using either a true north symbol or magnetic north symbol	Design a north symbol for both true north and magnetic north	

Topic 3. Surveying

Concept. Surveying is the precise method of finding locations, elevations and sites of objects on the earth. Surveys therefore become the bases for map or small plot drawings.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) All legal descriptions of any piece of land are done by surveying with a precision instrument	<p>Students will name the parts of a transit and give their uses</p> <ol style="list-style-type: none"> <li>1) legs</li> <li>2) 3 or 4 leveling screws</li> <li>3) compass</li> <li>4) horizontal vernier</li> <li>5) vertical vernier</li> <li>6) telescope</li> <li>7) stadia lines</li> <li>8) eye piece</li> <li>9) tangent screws</li> <li>10) plumb</li> </ol> <p>Given a transit students will read the vernier scales on it</p>	<p>Set up a transit and:</p> <ol style="list-style-type: none"> <li>a) level it</li> <li>b) plumb to a point on the ground</li> <li>c) give angular readings from the horizontal to objects</li> <li>d) give horizontal readings between points on the ground</li> </ol>	

Topic 3. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
<p>2) True north may be established from magnetic north using a transit and knowing the magnetic declination</p>	<p>Given a transit, students will survey and stake any angular line</p> <p>Students will set up an orderly set of notes from a survey</p>	<p>Survey a true N-S line</p> <p>Using a transit, set up and stake out a building site in a vacant lot or school area</p> <p>Using a transit and surveyors' tape students may survey a school and grounds and record all information complete with a sketch, date, name of surveyors, location and description of survey, distances, angles, elevations and all calculations</p>	
<p>3) Distances may be measured by using</p> <p>a) a transit and stadia rod</p> <p>b) direct measurement</p>	<p>Students will measure a lot or school site with a transit and stadia rod, then check this distance with a chain tape</p> <p>Given the equivalents students will convert chain measurements to any common measures</p>	<p>Measure real property</p> <p>Convert chain measurements to feet</p> <p>Survey a city or town lot, and draw up a scale drawing to match</p>	

Topic 3. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
<p>4) A military or rectangular grid is one method of location</p> <p>5) The universal method of location is by degrees of latitude and longitude from a central angle in the earth</p>	<p>Given a simple road map that has a grid layout, students will locate a given point from (z,y) co-ordinates</p> <p>On any map with latitude and longitude, students will interpret degree, seconds and minutes of latitude and longitude</p> <p>Given a map of the world, students will understand how the latitude and longitude system is set up and how it reads</p> <p>Using dividers and scales, students will set up a latitude-longitude grid of any area</p>	<p>Using inking equipment, suitable published maps of the school locale, plastic overlay, multiple dividers, students could draw a grid on the plastic in degrees, minutes and seconds to locate their school, then properly record the location</p> <p>On a 17 x 22 linen of film materials draw in pencil a 1 degree square grid area</p> <p>Subdivide the area into minutes and place these minute divisions around the border in graphic form then number each</p>	



Topic 4. Published Maps and Charts

Concept. Standardization is necessary for maps both on a world or regional level.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Canada has adopted a system of standardization for surveying and mapping	Given a map of Canada students will be able to select the appropriate map scale that is best suited to give information such as relief, resources, buildings and towns, etc. from map scales of:  1:25,000 1:50,000 1:125,000 1:250,000	Students could examine the various map scales and note the detail each gives. Students could give the index number for any scale map indicated and suggest the uses of each map scale	
2) Alberta also has adopted a series of standards for survey work	Students will identify township plans, survey plats and provincial maps		
3) The Canadian Governemnt has set up 5 systems of surveying to be used in Canada	On a map of Canada, students will locate the 1st to 6th meridian	On a map of Canada with Provinces shown and degrees of longitude, students may plot the meridians using geometrical constructions for dividing a linear distance into equal parts or by using multiple dividers	
4) Between each set of meridians is a gridwork of Townships and Ranges designated by number	From the 3rd system of survey students will give a land description using Townships, Ranges and Meridians	On a 1" = 16 or 1" = 32 mile map of Alberta, students may locate by Township, Range and Meridian of their city or town etc. with correct numbers and order	

Topic 4. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
5) Land forms (relief) must be illustrated in some manner on a flat drawing surface	From a township plan, students will be able to subdivide a township into Sections and Legal subdivisions and number each	On linen and using ink, mechanical lettering devices, technical pens and railroad pens (for roads), chain scale, or engineer's scale, students should draw a typical 3rd system township plat giving all the section numbers, legal subdivision numbers and road allowances	
	Given a map of Alberta, students will point out or number the base lines and correction lines		
	On myla film or linen, using tables, pencil then ink equipment and a suitable scale, students will draw a map grid of the S.E. corner of the province making it 4 townships high by 4 townships wide	Study various published maps and compare these to known valleys or hills (field trip) if necessary	

Topic 4. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
6) Cultural or physical features or both must be placed on topographic maps	Using commercial stripping film or contact films, students will show relief e.g. Letraset	View relief through stereoscopes with pairs of air photographs.	
	Using freehand or mechanical lettering plot "Spot Heights"	On a transparent overlay of air photographs, use line shading to show relief of the photo area	
	With a contour pen or technical pen draw structure contours and number the elevations	On a transparent overlay of air photographs, transfer relief with commercial symbols	
	Using colored pencil and solvent or water colors etc. show elevations by color density (layer tinting)	On an ozalid print using Prizma color and solvent or water colors, layer tint the above map	
	Given the grid developed earlier the student will transfer in pencil such major features as rivers, lakes, towns and cities using a published map of a different scale as reference	Draw a map in pencil	
	Students will complete the steps or sequence required to produce successfully a map by following these ordered guidelines: a) pencil a grid work b) pencil in topographic features c) ink in all lettering	Complete the above map in ink giving: a) graphic scale b) borders with latitude and longitude c) legend d) north symbol e) name of map area f) date and cartographer	



Topic 4. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
	d) ink physical and cultural features e) ink in grid lines		

Topic 5. Aerial Photographs

Concept. Aerial photographs are used to provide increased accuracy in mapping.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Canada uses air photography to assist in survey and map production	<p>Given overlapping sets of aerial photographs and stereoscopes, students will view photos in 3 dimension to understand the meaning of "relief"</p> <p>Given photographs, students will suggest uses for air photos for industry, planning boards, recreation areas or housing developments</p> <p>Using air photos, and transparent film, students will draw a small grid overlay of the photo to transfer topographical information from the photo to a map grid of the same area</p>	<p>On photographs students will pick out their school site or home, etc.</p> <p>High points of land or valleys will be observed and compared to published maps</p> <p>Students may take a field trip taking a set of photographs to compare the actual with the aerial picture</p>	

Topic 5. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
		<p>Using air photographs, students may plan a local subdivision for housing or industry taking advantage of existing roads, power lines, drainage, view sites. The legal description of the Meridian, Township, Range, Section and legal subdivision would also be given</p> <p>Students may draw a 2 Township square map with section lines and transfer topographical information from air photos to the map area</p> <p>Using the air photos, stereoscope and ink equipment students may draw in relief by using such symbols as Hachures or line shading</p>	

C. ARCHITECTURAL DRAWING 22 B



## C. ARCHITECTURAL DRAWING 22 B

### 1. Introduction

Architectural Drawing 22 B is a (five) 5-credit course, the purpose of which is to:

- a) familiarize the student with the properties, uses, advantages, and disadvantages of the common structural materials - wood, steel, and reinforced concrete.
- b) accustom the student to using manuals and manufacturer's catalogues to select suitable load bearing members and finish materials.
- c) familiarize the student with basic construction theory as applied to wood frame, steel and reinforced concrete.
- d) introduce the student to architectural drawing practices by having him draw a variety of typical details, sections, plans, and elevations involving wood, steel, and concrete construction.

It is expected that the teacher will combine theory and drawing practice in the way he feels best suited to his class. It is expected that the teacher will decide how much time to allot to each topic.

### 2. Textual Materials

*Architectural Drawing Practices* (Canadian Government Specifications Board)

\* *Architectural Drafting and Design* by Hepler and Wallach - McGraw-Hill

*Canadian Wood Frame House Construction* (CHMC)

*Residential Standards-Canada* (National Research Council)

*Structural Shop Drafting-Volumes 1 & 2* (American Institute of Steel Construction)

*Manual of Steel Construction* (American Institute of Steel Construction)

*Manual of Standard Practice for Detailing Reinforced Concrete Structures* (American Concrete Institute)

*Timber Construction Manual* (Canadian Institute of Timber Construction)

*Timber Design and Construction Handbook* (McGraw-Hill)

*Building Construction Handbook* (McGraw-Hill)

*Procedure Handbook of Arc Welding Design and Practice* (Lincoln Electric)

*Elementary Structural Shop Drafting* (Canadian Institute of Steel Construction)

*Building With Steel* - Halperin (American Tech. Soc.)

*Architectural Drawing and Planning* - Goodban and Hayslett

*Architectural Drafting* - Horung (Prentice-Hall) (McGraw-Hill)

*Architectural Drafting* - Stegman & Stegman (American Technical Society)

*Materials of Construction* - Smith (McGraw-Hill)



### 3. Course Content

#### Topic 1. Drawing Office and Fabricating Plant Organization

Concept. Drawing offices produce working drawings which are used in fabricating plants to produce parts, and at the site to facilitate the erection of the structure.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) An architectural drawing office produces presentation drawings and models to show the finished appearance of a structure and working drawings to enable the structure to be built.	The student should describe the organization of, and the work performed in an architectural drawing office.	a) visit architectural drawing office. b) examine architectural drawings.	
2) A structural steel drawing office produces detail drawings to enable all steel members of a structure to be fabricated, and erection drawings to enable these members to be assembled.	a) The student should describe the organization of, and the work performed in, a structural steel drawing office. b) The student should describe the organization of, and the operations performed in, the steel fabricating plant. c) The student should describe how structural steel is erected.	a) Visit steel fabricating plant. b) Examine steel erection drawings. c) Examine structural steel detail drawings.	

Topic 1. Continued

Sub-concept	Behavioral Objectives	Suggested Activities	Resource Materials
3) A reinforcing steel drawing produces bending schedules to enable reinforcing steel to be fabricated, and placing drawings to enable it to be correctly placed in the structure.	The student should describe the organization of, and the work performed in, a reinforcing steel drawing office. The student should be able to describe how reinforcing steel is bent and placed.	Visit a reinforcing steel plant. Examine bending schedules and placing drawings.	
4) A structural timber drawing office produces fabrication and erection drawings for timber members of a structure.	The student should describe the organization of, and the work performed in, a structural lumber drawing office. The student should describe how structural timber members are fabricated.	Visit a structural timber fabricating plant. Examine structural timber drawings.	

Topic 2. Construction Materials

Concept. Timber, steel and concrete, due to their particular properties, are the basic materials of construction.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Timber, in the form of structural timber, yard lumber, and plywood, is a basic construction material.	The student should describe the structure, composition, physical and mechanical properties of wood and plywood. The student should describe the grading procedures for, and the classification of, wood and plywood.	Lectures. Write Report.	

Topic 2. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
2) Steel, in the form of rolled structural shapes, is a basic construction material.	<p>The student should describe the structure, composition, physical and mechanical properties of steel.</p> <p>The student should describe grades of structural steel, their classification, properties and uses.</p> <p>The student should describe the sizes and tolerances of rolled steel structural shapes.</p>	<p>Lectures</p> <p>Write Report.</p>	
3) Reinforcing steel and concrete jointly form a basic construction material.	<p>The student should describe the structure, composition, physical and mechanical properties of reinforcing steel.</p> <p>The student should describe the structure, composition, physical and mechanical properties of concrete.</p>	<p>Lectures.</p> <p>Write Report.</p>	
4) A wide variety of finish materials are available for flooring, roofing, interior finish, insulation and damp proofing.	<p>The student should use manufacturer's catalogs to select finish material for a floor, a roof, interior wall and an exterior wall.</p> <p>The student should describe the way in which the above materials are applied.</p>		

### Topic 3. Construction Theory

Concept. Structures consist of load bearing elements which are designed to carry the loads imposed on the structure. Such elements are of wood, steel and concrete.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Residential construction in Canada is mainly conventional wood frame construction.	Given the size and type of construction the student will be able to draw the plans for constructing a wood frame building according to set standards. Given the tables in "Residential Standards" and "Canadian Wood Frame House Construction", the student will select columns, beams, joists, and trusses for a specified residence.	Draw or sketch construction details conforming to the requirements of "Residential Standards". Select load bearing members for various houses using tables.	
2) A steel structure consists of a number of rolled steel structural shapes, fastened together by bolts or by welding, which carry the imposed loads.	The student will draw or sketch standard construction details for the various members found in a steel framed industrial and commercial building. Given reference manuals the student will select appropriate connections suitable for beam-to-beam and beam-to-column fastening.	Draw or sketch standard details from Reinforced Concrete Manuals.	
3) In reinforced concrete structures the loads are carried by composite members of steel and concrete.	The student will draw or sketch standard details for - reinforced concrete members - pre-stressed concrete members.	Draw or sketch standard details from Reinforced Concrete Manuals.	



Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
4) In timber construction the imposed loads are carried by wood members.	The student will draw or sketch standard details for timber and laminated members in construction.	Draw or sketch standard details from Timber Construction Manuals.	

## Topic 4. Fasteners

Concept. Structures consist of many separate parts which must be fastened together. Nails, screws, bolts, glue, welding and other fasteners are used for this purpose.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Nails, screws, bolts, split rings and glue are used to fasten wood parts of a structure together.	The student will be able to draw or sketch the typical joints using common fasteners used in wood construction.	Draw or sketch typical joints using the different kinds of fasteners.	
2) Machine bolts and high strength bolts are used to fasten structural members together.	The student should describe the types, sizes and properties of bolts used as structural steel fasteners. The student should describe the three ways in which the bolts function (i.e. shear, bearing and tension).		
3) Welded connections are frequently used in structural steelwork.	The student should describe the electric arc welding process, the common types of weld, and the symbols used to represent welds.	Use standard welding symbols to describe the common kinds of welds.	

Topic 4. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
4) A variety of bar supports are used to locate accurately reinforcing steel in the form work prior to the pouring of the concrete.	The student should describe the use of bar supports to ensure the correct location of reinforcing steel in the concrete members.		

Topic 5. Drafting Practices

Concept. The various fields of drafting have each developed special drafting practices to deal with situations unique to their own particular specialty.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Architectural drafting utilizes lines, symbols, lettering, notes and abbreviations in the drawing of building plans, elevations, sections and details.	The student should draw a variety of building sections, elevations, and details of such features as stairs, windows, chimneys, etc., using standard architectural drafting practices.	Draw basement and main floor plans for a simple house. Draw wall sections for simple house. Draw elevations for simple house.	
2) Structural steel drafting utilizes standard drafting practices in the production of detail drawings of steel beams, columns, etc.,	The student should make detail drawings of simple beams and columns using steel manuals to select the connections (both welded and bolted). The student should make bills of material, shipping	Make detail drawing of a beam with bolted connections and with welded connections. Make detail drawing of a column with bolted connections	



Topic 5. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
<p>with bolted or welded connections.</p> <p>3) Reinforced concrete drafting utilizes standard drafting practices in the production of placing drawings showing the location, size and shape of reinforcing steel.</p> <p>4) Timber construction drafting utilizes standard drafting practices in the production of framing and connections details, material lists and hardware details for timber beams, trusses and columns.</p>	<p>lists and bolt lists.</p> <p>The student should draw details of reinforced concrete footings, foundations, beams, columns and splices. The student should draw up reinforcing schedules and make bar bending lists.</p> <p>The student should draw typical framing and connections details for timber beams, trusses and columns.</p>	<p>and with welded connections. Give student a detailed drawing and have him make bill of material, bolt list and shipping list.</p> <p>Draw simple foundation plan with reinforcing steel in walls and footings. Make reinforcing schedule and bar bending list for the above.</p> <p>Draw a simple timber truss. Draw composite lumber and plywood beam.</p>	

Topic 6. Presentation Drawings

Concept. One and two point perspective drawings are used to represent the interior and exterior appearance of a building.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Two point perspective drawings are used to show the exterior appearance of a building.	The student should describe the theory of two point perspective drawing. The student should lay out two point perspective drawings of simple buildings.	Make two point perspective drawings of simple objects. Make two point perspective drawings of a simple building.	
2) One point perspective drawings are used to show the interior appearance of a building.	The student should describe the theory of one point perspective drawings. The student should lay out one point perspective drawings to show interiors of rooms.	Make one point perspective drawings of several rooms in a house.	

D. MACHINE DRAWING I - 22 C



D. MACHINE DRAWING I - 22 C

1. Introduction

The Machine Drawing course provides information and activities that will acquaint the student with drawing conventions and give him an opportunity to practice the skills required by a draftsman.

2. Textual Materials

The following texts may be used as references. Those marked with an asterisk (\*) are considered the most helpful.

\* Jensen, C. H., *Engineering Drawing and Design*, McGraw-Hill.

Gieseckie, F. E., et al., *Technical Drawing*, Fifth Edition, Collier-MacMillan of Canada.

French, T. E., and C. J. Vierch, *A Manual of Engineering Drawing for Students and Draftsmen*, Tenth Edition, McGraw-Hill.

3. Course Content

Topic 1. Shape Description (Instrument Drawing and Sketching)

Concept. Drawing is a fundamental method of technical communication and is a requirement in both the designs of a part or machine and in the communication details of the part or machine to persons actually making, installing, or servicing the part or machine.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
1) Technical ideas may be expressed using different types of projection.	<p>The student, given the problem of drawing a machine or part, will draw the part in any projection which may be selected from the following:</p> <ul style="list-style-type: none"><li>a. Orthographic Projection<ul style="list-style-type: none"><li>-multiview</li><li>-axonometric</li><li>-isometric</li></ul></li><li>b. Oblique Projection<ul style="list-style-type: none"><li>-cavalier</li><li>-cabinet</li></ul></li></ul>		

Topic 1. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
<p>2) A knowledge of line language is fundamental in understanding technical drawings.</p> <p>3) Different types of drawings (projections) are used to communicate different types of information. Each of these has its appropriate uses and limitations.</p> <p>4) The ability to make quick, accurate, and clear sketches is a valuable aid in expressing technical ideas.</p>	<p>c. Perspective -one-point -two-point</p> <p>The student will demonstrate by drawings selected parts:</p> <p>a. The correct use of the line language</p> <p>b. The correct precedence of lines</p> <p>The student, given a problem in communication of technical information will be able to select the most suitable type of projection, the required views, and draw the part or machine in the selected projection.</p> <p>The student, given a problem in rapid communication of a technical idea, will be able to:</p> <p>a. Select the appropriate sketching materials (cross-section paper, special tracing paper, blank paper and master cross-section paper, pictorial grid paper, pencil, eraser, etc.)</p>		



Topic 1. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
	<p>b. Select the projection best suited to express the idea</p> <p>c. Use correct line technique</p> <p>d. Demonstrate good proportion in his sketches</p>		

Topic 2. Sectional Views and Conventions

Concept. Section views are necessary to reveal the interior of parts and/or machines.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
1) Cutting plane lines are used to show the location of imaginary cuts.	Given two or more views of a machine part, and the location of the imaginary cut, the student should draw the sectioned view.		
2) Section lining is used to indicate the material imaginarily cut.			
3) Different types of sections are needed to illustrate the interior detail of objects of varying shapes	The student, given the problem of drawing a machine part, will be able to select from the following, both the number and type of sections required:		

Topic 2. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
4) The rigid rules of projection may be modified if clarity and readability can be improved	<p>a. Full section</p> <p>b. Half section</p> <p>c. Offset section</p> <p>d. Revolved section</p> <p>e. Removed section</p> <p>The student, when assigned selected parts or machines draws either freehand or with instruments</p> <p>The student will draw the appropriate conventional practices from the following:</p> <p>a. Ribs in section</p> <p>b. Webs in section</p> <p>c. Aligned sections</p> <p>d. Spokes in section</p> <p>e. Partial views</p>		

Topic 3. Auxiliary Views

Concept. Auxiliary views are used to show the true size and shape of surfaces which are not parallel to any of the six regular planes of projection.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
1) Surfaces are classified as:	The student, when given a series of drawings, should be able to		

Topic 3. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
<ul style="list-style-type: none"> <li>a. Normal</li> <li>b. Inclined</li> <li>c. Oblique</li> </ul>	<p>identify normal, inclined, and oblique surfaces</p>		
<p>2) A definite order of steps is followed in drawing primary auxiliary views</p>	<p>The student should list, in order, the steps in drawing a primary auxiliary view:</p> <ul style="list-style-type: none"> <li>a. Select and draw the necessary standard views</li> <li>b. Number points on the standard views</li> <li>c. Draw projectors from standard views</li> <li>d. Establish reference planes</li> <li>e. Locate points on the auxiliary plane</li> <li>f. Complete the view on the auxiliary plane</li> </ul> <p>The student should be able to draw the primary auxiliary views of selected machine parts.</p>		
<p>3) Partial auxiliary views are used to simplify the drawing.</p>	<p>The student, when given selected problems, should:</p> <ul style="list-style-type: none"> <li>a. Select the necessary views and partial views</li> <li>b. Draw the necessary views</li> </ul>		

#### Topic 4. Dimensioning

Concent. Shape and size descriptions are required in completely describing an object.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
<p>1) Standard lines and symbols are used in dimensioning.</p>	<p>The student should correctly describe each of the following as they are used in correct dimensioning practice:</p> <ul style="list-style-type: none"> <li>a. Dimension forms</li> <li>b. Line weights</li> <li>c. Arrowheads</li> <li>d. Extension lines</li> <li>e. Leaders</li> <li>f. Figures</li> <li>g. Common fractions</li> <li>h. Feet and inches notation</li> <li>i. Reading direction of figures</li> <li>j. Systems of writing dimension values               <ul style="list-style-type: none"> <li>i) Common-fraction system</li> <li>ii) Common-fraction, decimal-fraction system</li> <li>iii) Complete decimal system</li> </ul> </li> <li>k. Finish marks</li> <li>l. Scale of drawing</li> </ul>		

Topic 4. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
<p>2) The usefulness of a drawing is largely determined by the selection and placement of dimensions and other information on the drawing.</p>	<p>The student should explain each of the following elements of dimensioning practice:</p> <ul style="list-style-type: none"> <li>a. Theory of dimensioning</li> <li>b. Size dimensions</li> <li>c. Location dimensions</li> <li>d. Selection of dimensions</li> <li>e. Superfluous dimensions</li> </ul>		
<p>3) There are specified methods of dimensioning standard features.</p>	<p>The student, when dimensioning drawings of machine parts, will be able to dimension correctly each of the following standard features in both orthographic and pictorial projections:</p> <ul style="list-style-type: none"> <li>a. Notes</li> <li>b. Angles</li> <li>c. Chamfers</li> <li>d. Tapers</li> <li>e. Arcs</li> <li>f. Curves</li> <li>g. Shapes with rounded ends</li> <li>h. Location dimensions</li> </ul>		

Topic 4. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
	<ul style="list-style-type: none"> <li>i. Dimensions and specifications for holes</li> <li>j. Cylindrical surfaces</li> <li>k. Spherical surfaces</li> <li>l. Curved surfaces</li> </ul>		

Topic 5. Fasteners

Concept. The designing and detailing of practical machines require a knowledge of the many different types of fasteners which are available to modern industry.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
<ul style="list-style-type: none"> <li>1) Screw threads are an important element in many fastening devices.</li> <li>2) There are two standard symbolic</li> </ul>	<p>The student should define each of the following thread terms:</p> <ul style="list-style-type: none"> <li>a. Screw thread</li> <li>b. External thread</li> <li>c. Internal thread</li> <li>d. Major diameter</li> <li>e. Lead</li> <li>f. Thread form</li> <li>g. Thread series</li> </ul> <p>The student should draw the two types of thread symbols correctly.</p>		



Topic 5. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
<p>methods of representing threads:</p> <p>1) Schematic</p> <p>2) Simplified</p> <p>3) The "V" thread form includes a number of thread series, including:</p> <p>1) Coarse thread series</p> <p>2) Fine thread series</p> <p>4) Thread notation and specification are done in a prescribed and standardized manner.</p> <p>5) Threads are used in a variety of fasteners including:</p> <p>a. Bolts</p> <p>b. Cap Screws</p> <p>c. Studs</p> <p>d. Machine Screws</p> <p>e. Set Screws</p>	<p>The student should be able to describe each of these thread series:</p> <p>a. Coarse thread</p> <p>b. Fine thread</p> <p>The student should list, in order, the elements of a correct thread notation and be able to specify a thread correctly.</p> <p>The student should be able to give examples of the correct application of each of the different threaded fasteners</p>		



E. ENGINEERING GRAPHICS 32 A



## E. ENGINEERING GRAPHICS 32A

### 1. Introduction

Many students, especially those who have aspirations to attend university find lack of time limits them in the number of technical courses they can take in high school. Engineering Graphics is a five credit course that will challenge the best students. It is designed to appeal to the student who has an interest in drafting and mathematics and who wants an in-depth theory oriented drafting course.

Students who register in this course should have one of the introductory courses or equivalent experiences.

### 2. Textual Materials

A textbook is not prescribed. The following reference books will be found helpful.

Luzadder. *Basic Graphics*. Prentice-Hall

French, T. E. and C. J. Vierch. *Graphic Science: Engineering Drawing, Descriptive Geometry, Graphic Solution*. McGraw-Hill, 1970

Giesecke, F. E. et al. *Technical Drawing*, (fifth edition). Collier-MacMillan Canada Ltd.

Jensen, C. H. *Engineering Drawing and Design*. McGraw-Hill, Toronto, 1968

Giachino, J. W., and H. J. Beukema. *Engineering-Technical Drafting and Graphics*. General Publishing Co. Ltd., 1966

Giachino, J. W., and H. J. Beukema. *Engineering-Technical Drafting and Graphics, Study Guide 2*. General Publishing Co. Ltd., 1967.

### 3. Course Content

Topic 1. Instruments.

Concept. Care and use of equipment is an integral part of the production of accurate solutions to engineering problems.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Drafting equipment must be in good repair to produce accurate drawings	Given specified equipment, the student will account for this equipment and will be able to adjust and care for this equipment in a manner prescribed by the teacher & most textbooks	Count equipment daily. Adjust equipment properly before it is used.	

Topic 1. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
2) Drafting equipment must be used in a special manner	The student will use the equipment specified by the teacher in a manner prescribed by the teacher and textbooks	Produce drawings using equipment issued	

Topic 2. Lettering.

Concept. Lettering is a skill basic to the use of engineering graphics.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Gothic vertical, upper case is most used and is basic to most other forms of lettering	The student will produce uniform legible, dense, sharp vertical upper case letters that are correctly proportioned and are correctly spaced in words and sentences	Practice lettering regularly both on drawings and on separate lettering sheets	

Topic 3. Drafting Geometry.

Concept. Drafting geometry is basic to the use of engineering graphics in solving problems.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) A knowledge of geometrical constructions is required in the solution of engineering problems	Given a specified geometrical construction, the student will describe the process of the geometrical construction	Oral descriptions to the class with the aid of black-board sketches. Written tests.	



Topic 3. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
2) Geometrical constructions are applied to the drawing of objects	<p>Given a set of drawing instruments the student will correctly draw objects which incorporate the following geometric constructions:</p> <ul style="list-style-type: none"> <li>a) all constructions from Introductory Drafting</li> <li>b) layout an angle <ul style="list-style-type: none"> <li>i) tangent method</li> <li>ii) sine method</li> <li>iii) chord method</li> </ul> </li> <li>c) an ogee curve</li> <li>d) a parabola</li> <li>e) a helix</li> <li>f) an involute</li> <li>g) a spiral of archimedes</li> <li>h) a cycloid</li> </ul>	Draw objects which incorporate specific constructions	

Topic 4. Shape Descriptions.

Concept. Shape description is basic to the solution of problems using engineering graphics.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Problems may be solved by using different types of projection	<p>The student will make freehand sketches of a given object using any of the following projections:</p> <ul style="list-style-type: none"> <li>a) perspective</li> <li>b) orthographic multiview</li> <li>c) axonometric</li> <li>d) oblique</li> </ul>	Sketch objects in specified projection	

Topic 4. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
	<p>The student will control the line thickness and demonstrate the correct use of the line language in producing instrument drawings of objects using the following projections:</p> <ul style="list-style-type: none"> <li>a) orthographic multiview (incl. auxiliaries)</li> <li>b) axonometric (esp. isometric)</li> <li>c) oblique</li> </ul> <p>Given a multiview drawing the student will find:</p> <ul style="list-style-type: none"> <li>a) the true length of a line</li> <li>b) the point projection of a line</li> <li>c) the true size and shape of a surface</li> </ul>	<p>Draw objects using instruments</p>          <p>Oral and written questions</p>          <p>Given an object, draw it such that he will find a), b) or c).</p>	

Topic 5. Descriptive Geometry.

Concept. Problems in engineering design may be solved by applying the basic principles of orthographic projection.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Auxiliary views are basic to descriptive geometry	Given two or more views of a line, the student will determine the true length of the line when the line is: a) vertical b) horizontal c) inclined d) oblique	Note the correct true length line on a drawing	
	Given the above lines the student will determine the point view of the line	Complete a drawing to show line in its true length	
	Given two or more views of two skewed lines, the student will find the shortest distance between them	Complete given drawings to find distance	
	Given two or more views of a plane, the student will draw the edge view of the plane	Tests tell which view the edge view is on. Draw edge view	
	Given two or more views of a plane the student will find the true shape of the plane		
	Given two or more views of a line and a plane the student will determine the angle between the line and the plane		

Topic 5. Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
	<p>The student will find the dihedral angle between two intersecting oblique planes</p> <p>Given a line which passes through an oblique plane the student will find the piercing point of the plane</p>		

Topic 6. Revolutions.

Concept. Many engineering problems can be solved by revolving the views.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) True lengths of lines, edge views of planes, true shapes of planes can be found by revolving the principal views	<p>Given two or more views of an object the student will re-draw the views, revolving one or more views in a specified manner</p> <p>Given an object with an inclined surface the student will be able to find the following:</p> <ul style="list-style-type: none"> <li>a) the true length of a line</li> <li>b) the true size of a plane</li> <li>c) the dihedral angle</li> <li>d) the angle a line makes with a plane</li> </ul>	<p>Draw simple revolutions of given normal views</p> <p>Revolve views to find required information</p>	

Topic 6. Continued.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
	Given an object with an oblique surface, the student will determine the true shape of the surface by revolution.		

Topic 7. Developments and Intersections.

Concept. A comprehensive study of developments and intersections is a part of descriptive geometry.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) A layout of a complete surface is a development	Given objects specified from the list below, the student will layout the complete surface of the object: a) prisms of all shapes b) pyramid c) cone d) cylinder e) oblique prism f) truncated cone g) transition pieces	Draw layouts	
2) The line of intersection is found by determining a number of points common to both surfaces and by drawing a line or lines through these points	Given two intersecting surfaces, the student will find the line that is common to them both: a) in problems involving plane surfaces b) in problems involving two surfaces that are single curved or double curved	Make objects from cardboard	

Topic 7. Continued.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
		Complete partial drawings of intersecting geometric shapes  Draw two or more views of objects which have intersecting surfaces	

Topic 8. Vector Geometry.

Concept. Vector geometry is used in the solution of special kinds of problems that arise in design.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Vector geometry is used to find the magnitude, direction, composition and resolution of forces	Given two vector forces the student will determine the direction and magnitude of the resultant force	Graphically solve written problems	Vector diagram. Answer to problem
	Given three or more forces the student will determine the resultant force	"	"
	Given a force the student will resolve this force into two or more components and into two components of a given direction	"	"
	Given two forces, the student will determine the equilibrant	"	"



Topic 9. Graphic Presentations.

Concept. Graphs, charts and diagrams are used to convey correlated data and engineering facts and statistics.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) There are several basic types of graphs	<p>The student will identify specified types of graphs and give advantages and uses of each type: e.g. line bar surface or area pie chart volume</p> <p>Given a list of data the student will set this information down in a graph of the specified form</p> <p>Given a list of data the student will determine the graph form best suited to convey these data and then draw the graph correctly showing the required data</p>	<p>Orally discuss a type of graph or answer questions on a written test</p> <p>Construct graphs showing required data</p>	

Topic 10. Individual Project.

Concept. Students in this course will be capable of considerable self-direction.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
	<p>The student will solve the design problems and draw a set of plans required for a project of his own choosing</p>		



F. ARCHITECTURAL DRAWING II - 32 B



F. ARCHITECTURAL DRAWING II - 32B

1. Introduction

The aims of this course are

- a. To have the student produce working drawings of a standard that would be acceptable in the building construction industry.
- b. To introduce the student to the four different areas of drafting within the broad field of building construction drafting. (i.e. architectural, structural steel, reinforced concrete, and structural timber drafting.)
- c. To have the student use manuals, standards and reference books to find information necessary to produce working drawings.
- d. To have the student understand, and be able to use, standard drafting practices in the production of working drawings.

It is intended that this course be organized around a number of projects. The student should apply the knowledge and skills acquired in Architectural Drawing I to produce working drawings.

The student should work from engineering drawings, sketches, and written and verbal instructions.

The teacher should allot time in the way he feels best suited to his class, but approximately half the course should be spent on producing a set of working drawings for a house.

2. Textual Materials

Same as for Architectural Drawing I.

### 3. Course Content

#### Topic. Working Drawings

Concept. A draftsman conveys full and detailed instructions for the fabrication and erection of buildings and other structures by means of working drawings.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) A set of architectural working drawings for a house consists of floor plans, elevations, sections, stair and chimney details, room schedules, and a plot plan.	a) The student should draw a complete set of working drawings for a house. b) The student should make his working drawings conform to the requirements of "Residential Standards Canada". c) The student should use acceptable architectural drafting practices.	Produce a set of working drawings for a house, about 1,200 sq. ft. in area, built by conventional wood frame construction.	
2) Erection (or engineering) drawings give the draftsman the necessary information to produce detail shop drawings of structural steel members such as beams, columns, trusses and bracing.	a) The student should read and interpret structural steel erection (or engineering) drawings. b) The student should use a steel construction manual to select suitable connection details. c) The student should (given a set of erection drawings) draw detail shop drawings of a beam, a column, a truss and cross bracing.	Make detail shop drawings of structural steel members either from an erection drawing or from engineering drawings selected from one of the reference texts. Make an erection drawing of a simple structural steel structure.	



G. MACHINE DRAWING II - 32 C



Topic. Working Drawings - Continued

Sub-Concept	Behavioral Objectives	Suggested Activities	
<p>3) Reinforced concrete drafting involves</p> <p>a) making bar bending lists, so that the reinforcing steel can be fabricated to the correct shape</p> <p>b) making placing drawings so that the reinforcing steel can be accurately located in its correct position in the structure.</p>	<p>a) The student should read and interpret reinforced concrete engineering drawings.</p> <p>b) The student should draw placing drawings for a simple reinforced concrete structure.</p> <p>c) The student should make bar bending lists for the reinforcing steel.</p> <p>d) The student should locate the necessary information in reinforced concrete manuals.</p>	<p>Make bar bending lists and placing drawings for the reinforcing steel in a simple structure selected from one of the reference texts.</p>	
<p>4) Timber construction drafting involves the production of framing details, connection details, material lists and hardware details for timber beams, columns and trusses.</p>	<p>a) The student should draw complete working drawings for timber beams, columns and trusses showing framing, connection, and hardware details.</p> <p>b) The student should locate necessary information in timber construction manuals.</p>	<p>Make complete working drawings of structural timber members from problems in reference texts.</p>	



G. MACHINE DRAWING II - 32 C

1. Introduction

This course expands on the materials studied in Machine Drafting I going into greater detail in shape description, materials and fasteners.

2. Textual Materials

The same references as listed for Machine Drawing I are applicable to this course.

3. Course Content

Topic 1. Shape Description (Instrument Drawing and Sketching)

Concept. Drawing is a fundamental method of technical communication and is a requirement in both the design of a part or machine and in the communication of details of the part or machine to persons actually making, installing, or servicing the part or machine.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
1) Technical ideas may be expressed using different types of projection.	<p>The student, given the problem of drawing a machine or part, will be capable of drawing the part in any projection which may be selected from the following:</p> <ul style="list-style-type: none"><li>a. Orthographic Projection<ul style="list-style-type: none"><li>i) Multiview</li><li>ii) Axonometric<ul style="list-style-type: none"><li>-Isometric</li><li>-Dimetric</li><li>-Trimetric</li></ul></li></ul></li><li>b. Oblique Projection<ul style="list-style-type: none"><li>i) Cavalier</li><li>ii) Cabinet</li></ul></li><li>c. Perspective<ul style="list-style-type: none"><li>i) One-point</li><li>ii) Two-point</li><li>iii) Three-point</li></ul></li></ul>		

Topic 1. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
2) A knowledge of line language is fundamental in understanding technical drawings.	Demonstrate, in drawings of selected parts, the correct use of the line language		

Topic 2. Sectional Views and Conventions

Concept. Section views are necessary to reveal the interior of parts and/or machines.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
1) Different types of sections are needed to illustrate the interior detail of objects of varying shapes.	<p>The student, given the problem of drawing a machine part, will be able to select from the following, both the number and type of sections required:</p> <ul style="list-style-type: none"> <li>a. Full section</li> <li>b. Half section</li> <li>c. Offset section</li> <li>d. Broken-out section</li> <li>e. Revolved section</li> <li>f. Removed section</li> <li>g. Phantom section</li> <li>h. Assembly sections               <ul style="list-style-type: none"> <li>i) Multiview</li> <li>ii) Pictorial</li> </ul> </li> </ul>		



Topic 2. Continued

Sub-Concepts	Behaviorial Objectives	Suggested Activities	Resource Materials
<p>2) The rigid rules of projection may be modified if clarity and readability can be improved.</p>	<p>The student, when assigned selected parts or machines to be drawn, either freehand or with instruments, will be able to select and draw the appropriate conventional practices from the following:</p> <ul style="list-style-type: none"> <li>a. Ribs in section</li> <li>b. Webs in section</li> <li>c. Aligned sections</li> <li>d. Spokes in section</li> <li>e. Partial views</li> <li>f. Intersections in section</li> <li>g. Conventional breaks</li> <li>h. Adjacent parts in section</li> <li>i. Treatment of large areas in section</li> <li>j. Treatment of thin materials in section</li> </ul>		

### Topic 3. Auxiliary Views

Concept. Auxiliary views are used to show the true size and shape of surfaces which are not parallel to any of the six regular planes of projection.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
1) Surfaces are classified as:  a. Normal  b. Inclined  c. Oblique	The student, when given a series of drawings, should identify normal, inclined and oblique surfaces.		
2) A definite order of steps is followed in drawing primary auxiliary views.	<p>The student should be able to list, in order, the steps in drawing a primary auxiliary view:</p> <ul style="list-style-type: none"><li>a. Select and draw the necessary standard views</li><li>b. Number points on the standard views</li><li>c. Draw projectors from the standard views</li><li>d. Establish reference planes</li><li>e. Locate points on the auxiliary plane</li><li>f. Complete the view on the auxiliary plane</li></ul> <p>The student should draw the primary auxiliary views of selected machine parts.</p>		

Topic 3. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
<p>3) A definite order of steps is followed in drawing secondary auxiliary views.</p>	<p>The student will list, in order, the steps in drawing a secondary auxiliary view:</p> <ol style="list-style-type: none"> <li>Select and draw the necessary standard views</li> <li>Establish the reference plane line in the standard for required edge view</li> <li>Draw projectors from the standard view</li> <li>Complete the edge view</li> <li>Complete the secondary auxiliary using both the specifications and the procedure for drawing primary auxiliaries.</li> </ol> <p>Students will draw the secondary auxiliary views of selected machine parts.</p>		
<p>4) Partial auxiliary views are used to simplify the drawing.</p>	<p>The student, when given selected problems, should be able to:</p> <ol style="list-style-type: none"> <li>Select the necessary views and partial views</li> <li>Draw the necessary views</li> </ol>		

Topic 4. Dimensioning

Concent. Shape and size descriptions are required in completely describing an object.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
<p>1) Standard lines and symbols are used in dimensioning.</p>	<p>The student will correctly describe each of the following as they are used in correct dimensioning practice:</p> <ul style="list-style-type: none"> <li>a. Dimension forms</li> <li>b. Line weights</li> <li>c. Arrowheads</li> <li>d. Extension lines</li> <li>e. Leaders</li> <li>f. Figures</li> <li>g. Common fractions</li> <li>h. Feet and inches notation</li> <li>i. Reading direction of figures</li> <li>j. Systems of writing dimension values               <ul style="list-style-type: none"> <li>i) Common-fraction system</li> <li>ii) Common-fraction, decimal-fraction system</li> <li>iii) Complete decimal system</li> </ul> </li> <li>k. Finish marks</li> <li>l. Scale of drawing</li> </ul>		

Topic 4. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
<p>2) The usefulness of a drawing is largely determined by the selection and placement of dimensions and other information on the drawings.</p>	<p>The student will explain each of the following elements of dimensioning practice:</p> <ul style="list-style-type: none"> <li>a. Theory of dimensioning</li> <li>b. Size dimensions</li> <li>c. Location dimensions</li> <li>d. Selection of dimensions</li> <li>e. Correlation of dimensions for mating parts</li> <li>f. Superfluous dimensions</li> <li>g. Reference dimensions</li> <li>h. Selection of datum</li> <li>i. Dimensions from datum</li> <li>j. Basic dimensions</li> <li>k. Maximum and minimum sizes</li> </ul>		
<p>3) There are specified methods of dimensioning standard features.</p>	<p>The student, when dimensioning drawings of machine parts, will correctly dimension each of the following standard features in both orthographic and pictorial projections:</p> <ul style="list-style-type: none"> <li>a. Notes</li> <li>b. Angles</li> </ul>		

Topic 4. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
	<ul style="list-style-type: none"> <li>c. Chamfers</li> <li>d. Tapers</li> <li>e. Arcs</li> <li>f. Curves</li> <li>g. Shapes with rounded ends</li> <li>h. Location of holes</li> <li>i. Dimensions and specifications for holes</li> <li>j. Cylindrical surfaces</li> <li>k. Spherical surfaces</li> <li>l. Curved surfaces</li> </ul>		

Topic 5. Shop Processes

Concept. Shop processes involve changing the shape and size of material.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
1) Basic methods of changing shape and size of material involve removing some of the original material, adding more material, and redistributing original material.	The student, when given drawings of simple machine parts, will identify the basic method used in making the part.		



Topic 5. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
	The student, when given drawings of machine parts will identify the shop processes required in the manufacture of the part.	<p>List methods of casting.</p> <p>Read about machine tools and processes:</p> <ul style="list-style-type: none"> <li>a. Engine lathe</li> <li>b. Drill press</li> <li>c. Milling machine</li> <li>d. Shaper</li> <li>e. Planer</li> <li>f. Grinder</li> <li>g. Boring mill</li> <li>h. Broaching</li> <li>i. Forging</li> <li>j. Heat treating</li> </ul>	

Topic 6. Tolerancing

Concept. Modern industry is possible because of interchangeability and mass production of parts.

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
1) Tolerance terms	<p>The student will define each of the tolerancing terms:</p> <ul style="list-style-type: none"> <li>a. Tolerance <ul style="list-style-type: none"> <li>i) Unilateral Tolerance</li> <li>ii) Bilateral Tolerance</li> </ul> </li> </ul>		

Topic 6. Continued

Sub-Concepts	Behavioral Objectives	Suggested Activities	Resource Materials
<p>2) There are three basic types of fits:</p> <ul style="list-style-type: none"> <li>a. Clearance fit</li> <li>b. Interference fit</li> <li>c. Transition fit</li> </ul> <p>3) There are two basic tolerance systems:</p> <ul style="list-style-type: none"> <li>a. Basic Hole System</li> <li>b. Basic Shaft System</li> </ul> <p>4) There are prescribed methods of specifying tolerances.</p> <p>5) Selective assembly may be used to help offset the high cost of precision machinery and still maintain small tolerances.</p>	<ul style="list-style-type: none"> <li>b. Allowance</li> <li>c. Limit</li> <li>d. Nominal size</li> <li>e. Basic size</li> <li>f. Design size</li> </ul> <p>The student will describe each of the types of fit.</p> <p>The student will be able to state the conditions under which each system is used.</p> <p>The student will correctly dimension a simple machine which has interchangeable parts.</p>		

Topic 7. Fasteners.

Concept. The designing and detailing of practical machines require a knowledge of the many different types of fasteners which are available to modern industry.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Screw threads are an important element in many fastening devices	<p>The student will define each of the following thread terms:</p> <ol style="list-style-type: none"> <li>1) screw thread</li> <li>2) external thread</li> <li>3) internal thread</li> <li>4) pitch</li> <li>5) pitch diameter</li> <li>6) major diameter</li> <li>7) minor diameter</li> <li>8) lead</li> <li>9) crest</li> <li>10) root</li> <li>11) thread angle</li> <li>12) thread form</li> <li>13) thread series</li> </ol>		
<p>2) There are several standard methods of thread representation:</p> <ol style="list-style-type: none"> <li>a) detail representation</li> <li>b) thread symbols               <ol style="list-style-type: none"> <li>i) schematic</li> <li>ii) simplified</li> </ol> </li> </ol>	<p>The student should be able to draw each of the following thread forms in detailed representation:</p> <ol style="list-style-type: none"> <li>1) "v" type threads</li> <li>2) square threads</li> <li>3) acme threads</li> </ol> <p>The student will draw the two types of thread symbols correctly</p>		
3) There are various classes of thread yet each of which has types of applications for which it is best suited	<p>The student will name the classes of thread fit and be able to state the characteristics of each class of fit.</p>		

Topic 7. Continued.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
	<p>The student will describe each of these thread series:</p> <ul style="list-style-type: none"> <li>a) coarse</li> <li>b) fine</li> <li>c) extra fine</li> <li>d) 8-pitch</li> <li>e) 12-pitch</li> <li>f) 16-pitch</li> </ul> <p>4) Thread notation and specification and done in a prescribed and standardized manner</p> <p>5) Threads are used in a variety of fasteners</p> <p>6) Threaded holes must be drilled to the correct size before internal threads can be cut</p> <p>7) Bolts and nuts made in standard series and in standard finishes as well as in standard length and thicknesses</p>		

Topic 7. Continued.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
<p>8) There is a standardized method of specifying bolts and nuts</p> <p>9) Various locking devices are used in conjunction with threaded fasteners to prevent the fastener from becoming loose or out of adjustment</p> <p>10) In addition to threaded fasteners there are many other semi-permanent as well as permanent fasteners used in the production of machines and machine parts</p>	<p>The student will list, in order, the elements of bolt and thread specification and be able to specify nuts and bolts correctly</p> <p>The student will give the correct application, be able to represent graphically, each of the following locking devices:</p> <ul style="list-style-type: none"> <li>a) jam nuts</li> <li>b) lock washers</li> <li>c) cotter pins</li> <li>d) slotted nuts</li> <li>e) castle nuts</li> </ul> <p>The student will list some uses, be able to represent graphically and specify correctly each of the following types of fasteners:</p> <ul style="list-style-type: none"> <li>a) keys square, flat, gib head, splines, Pratt and Whitney, woodruff</li> <li>b) machine pins, taper, dowel, clevis, cotter</li> </ul> <p>The student should be able to list some applications of rivets and be aware of the uses of the following:</p> <ul style="list-style-type: none"> <li>a) rivets, tubular, semitubular, split, compression</li> </ul>		

Topic 7. Continued.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
<p>11) Welding joins various pieces of metal so that they function as a unit. A draftsman, if he is to be able to design a functional machine, should have a knowledge of the basic principles of welding practices and their application in manufacturing processes</p>	<p>The student should sketch and name each of the following types of welded joints:</p> <ul style="list-style-type: none"><li>a) butt</li><li>b) corner</li><li>c) tee</li><li>d) lap</li><li>e) edge</li></ul> <p>The student should be able to sketch and name each of the following types of welds:</p> <ul style="list-style-type: none"><li>a) bead</li><li>b) fillet</li><li>c) plug or slot</li><li>d) square</li><li>e) V</li><li>f) bevel</li><li>g) U</li><li>h) J</li></ul> <p>The student will list the advantages and disadvantages of welding as a manufacturing process</p>		



Topic 8. Working Drawings.

Concept. Information for the manufacture and assembly of a machine is conveyed by a working drawing.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Detail drawings provide shape and size description and include specifications when they are required.	Students will name and describe the elements of detail drawing.		
2) Assembly drawings give directions for the assembly of machines	The student will select the appropriate assembly drawing from the following: a) detailed assembly b) design assembly c) installation assembly e) exploded assembly		
3) A bill of materials, numbers, names, describes and species the quantities of each part in a sub-assembly or machine	The student will correctly layout and letter bills of materials		

Topic 9. Springs.

Concept. A spring is a mechanical device designed to store and release energy.

Sub-Concept	Behavioral Objectives	Suggested Activities	Resource Materials
1) Springs perform an important function in the designing of mechanical equipment	<p>The student, when given a problem involving the use of springs, should be able to select, but not necessarily design, the appropriate spring from the following classes and types of springs:</p> <ul style="list-style-type: none"><li>a) classes of springs<ul style="list-style-type: none"><li>i) wire</li><li>ii) flat</li></ul></li><li>b) types of springs<ul style="list-style-type: none"><li>i) compression</li><li>ii) extension</li><li>iii) torsion</li><li>iv) power</li></ul></li></ul> <p>The student should also be able to draw both the detail and schematic representation for springs</p>		



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